1,125,031

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,125,031

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Int. Cl.:—F 16 j 9/06.

COMPLETE SPECIFICATION

A device for exerting a radially directed thrust for piston rings

I, EMILE RAYMOND RENE GREIFENSTEIN, a Swiss citizen of 27, rue Saint-Ferdinand, Paris (17) France, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates generally to piston rings provided between the pistons and cylinders of internal combustion engines, compressors, pumps or similar machines. Such rings are made of one or several elements constituting the ring proper and often comprise an axially acting spring which applies said element or elements against the cylinder walls and generally comprises a strip made of steel or another suitable material abutted against the bottom of the piston groove and exerting an outwardly directed radial thrust on said element or elements.

A piston ring provided with such a radially acting spring can be efficiently used only in a piston groove having a suitable depth which has been preset to the utmost accuracy and cannot accordingly be used on all types of pistons.

Moreover a direct contact between the spring and the element or elements of the piston ring, during operation, wears away the spring along its outer perimeter, and consequently alters the thrust that is exerted. Such wear is particularly noticeable when using some materials, particularly when the element or elements of the piston ring are made of cast iron or steel.

An object of the invention is to remedy the disadvantages of the known constructions and to provide a device capable of exerting a radial thrust or push and adaptable to such piston rings as are not abutted against the bottom of the piston groove *i.e.* utilizable on pistons of different types whose grooves have different depths.

Another object of the invention is to provide a device capable of eliminating the wear undergone by the spring during operation due to its contact with the elements of the piston ring.

According to the invention there is provided a device utilizable in a composite piston ring of the type comprising two annular flat oil-scraping elements having an inner edge and an outer peripheral edge, for operatively pressing said outer edge against the cylinder walls for scraping oil therefrom, characterized by the fact that it comprises an annular thrust strip or band providing on its inner surface a middle seat portion, and an annular spring compressively located within said thrust strip and seated on this strip seat portion, said strip having upper and lower edge bearing portions and being pressed through said edge bearing portions against the inner edge of said oil-scraping elements for operatively pressing the outer edge of said elements against said cylinder walls.

Thus, in the assembled piston ring, the oil-scraping elements are in contact with the thrust strip so that the wear undergone by the spring and resulting for example from the heating action which may take place between said elements and said spring is in principle elimnated. Moreover, owing to the fact that the spring is housed in the piston groove in a state of circumferential compression, this spring is closely applied outwardly against the thrust strip without being abutted against the bottom of the groove which consequently may have any convenient depth. Owing to this arrangement, the spring keeps its entire strength and release freedom.

Further according to the invention there

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is provided a modification of the above device, wherein the edge bearing portions of the strip are replaced by outwardly directed horizontal parts resiliently pressed against the walls of the piston groove and having the outer free edge acting as an oil-scraping element of the piston ring.

Further according to the invention there is provided a piston ring of the type comprising two annular flat oil-scraping elements and a device as set forth above.

The invention is applicable to all piston rings irrespective of their shape and of the material of which they are made. Thus the invention can be used in connection with piston rings made of steel, cast iron, bronze, brass, synthetic or natural rubber, leather, "Teflon" (Registered Trade Mark), or plastics. The invention is also applicable particularly to oil-scraping rings of the conventional type or including an apertured spacer made of cast iron, also to such multiple elements as comprise an axially acting spacer or expander (made for example of steel).

The invention is illustrated by way of example in the accompanying drawings, wherein:

Figure 1 is a sectional view of a first constructional form of the device as it is fitted in the groove of a piston.

Figure 2 is a fragmentary view showing the thrust strip or band included in the device shown in Fig. 1.

Figure 3 is an edge view corresponding to Fig. 2.

Figure 4 is a sectional view on the line IV-IV in Fig. 2.

Figure 5 is a perspective view of another constructional form of the device.

Figure 6 is a longitudinal sectional view of still another constructional form of the device.

Figure 7 is an elevational view showing the thrust strip or band of the construction shown in Fig. 6, in the direction indicated by the arrow VII.

Figure 8 is a view similar to Fig. 6 showing another constructional form of the device.

Figure 9 is an elevational view showing the thrust strip or band of the constructional form shown in Fig. 8 as viewed in the direction shown by the arrow IX.

Figure 10 is a longitudinal sectional view of yet another constructional form of the device.

Figure 11 is a sectional view of another constructional form of the device.

Figure 12 is a sectional view of yet another constructional form of the device.

Figures 13 and 14 are views similar to Fig. 12 respectively showing two further constructional forms of the device.

In Fig. 1 are represented the body 1 of a piston and its groove 2 in which is received a piston ring made up of four elements 3, 4, 5, 6 associated with an undulated spacer 7. A radial thrust device is also provided which comprises a thrust strip or band 8 whose circumferential length substantially matches the length of the inner periphery of the elements of which the piston ring is made up. Such strip or band 8 has a suitable outline so as to provide recesses 9 in which is received a helical spring 10 having an annular or toroidal shape whose ends are so abutted as to permit it to be mounted in a state of circumferential compression. Apertures 11 are provided between neighbouring recesses 9 so as to enable oil that is scraped from the inner walls of the cylinder 12 to flow through apertures 13 in the bottom surface of the piston groove 2.

As visible in fig. 1, the helical spring 10 is closely abutted outwardly against the thrust strip or band 8 without contacting the bottom surface of the piston groove 2.

In order to impart an increased mechanical resistance to the edge bearing portions 14 of the strip or band 8 that are in contact with the piston ring elements, said band 8 is provided with undulated bars 15 of small size which impart to it some flexibility while permitting the helical spring 10 to keep its entire strength and release freedom. The portions 16 which connect the recesses 9 with the bearings 14 exert a thrust or push upon the elements 5 and 6 so that the latter first come into contact with the walls of the cylinder 12 before the elements 3 and 4. This while substantially lessening the running-in time of the piston rings in the cylinder 12 ensures an immediate tightness between the latter and the piston.

In the constructional form shown in fig. 5, the thrust strip or band is constituted by a steel sheet or ribbon 17 in which are provided apertures 18 and notches 19, the helical spring 10 being retained by bent in lugs 20.

In the showing of figs. 6 and 7 is illustrated another constructional form of the invention similar to the one shown in fig. 1 and in which the helical spring 10 is held down in recess 21 of the thrust strip or band 22 by cut out and bent in lugs 23.

In figs. 8 and 9 is shown another constructional form of the device in which the elements 3, 4, 5 and 6 of which the piston ring is made up are associated with an oil-scraping element 24 having apertures 25. In this form, the thrust strip or band 22 is similar to the one shown in the preceding example and also has recesses 21 for receiving the helical spring 10, also cut out and bent in lugs 23 for holding down said spring in said recesses. The strip or band 22

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is bent at right angles as shown at 26 so as to impart an increased stiffness to the bearings 27 and is notched at 28 for enhancing its flexibility and permit the same to match the irregular form of worn away cylinders.

In the showing of fig. 10 is represented another constructional form of the improved device comprising a piston ring made up of an oil-scraping element 29 having apertures 30, a thrust strip or band 31 and a helical spring 32 having a flat portion 33, i.e. a portion of non-annular cross-section, which bears outwardly against the thrust strip 31, the spring 32 being retained by cut out and bent in lugs 34.

It will be seen that this device which is not abutted against the bottom surface of the piston groove can be used on different pistons having grooves that also have different depths.

In the constructional form shown in fig. 11, the thrust strip or band 35 has a substantially vertical portion which preferably has such an outline as to provide a middle zone 36 behaving as a seat or recess for the spring 10, said vertical portion having extensions in the form of inwardly extending horizontal parts 37 carrying lugs 38 for retaining the spring 10.

The horizontal parts 37 terminate inwardly in the form of heel portions 39 which transmit the radial thrust or push to the elements 40, 41 of the piston ring that bear upon said horizontal parts 37 and are thus urged both against the cylinder walls and against the groove flanks. Apertures 42 which are preferably staggered relative to the lugs 38 for holding back the spring 10 are preferably formed in the substantially vertical portion of the strip or band 35.

In the showing of fig. 12 is represented a constructional form in which the strip 43 has a rounded portion 44 behaving as a seat or recess for the spring 10 and associated with spring-retaining lugs 45, and outwardly directed horizontal portions 46 extending from the marginal zones of the rounded portion 44. The spring-retaining lugs 45 are formed by cutting out the strip 43 so as to provide passages 43a for the flow of scraped oil. The horizontal portions 46 cooperate with flat portions 47 on the piston ring for transmitting the radial thrust. Apertures 48 similar to the apertures 42 are staggered with respect to the lugs 45 retaining the spring 10. Other lugs 45a formed by cutting out the strip 43 and having a bowed outline permit the flat portions 47 to be held against the horizontal portions 46.

In the constructional form shown in fig. 13, the strip or band 49 is made up of a sequence of lengths 50 which provide on one side a fulcrum zone 51 for the spring 10 and on the other side a horizontal zone 52 as a fulcrum and urging surface for the associated flat portion or portions 53 of the piston ring, said lengths being mutually alternated, lugs 54 being provided for retaining the spring 10. In this embodiment, each horizontal portion 52 terminates inwardly in the form of a heel 55 which transmits the radial thrust to the flat portion 53 of the piston ring.

In fig. 14 is shown another constructional form according to which the strip 56 has a rounded portion 57 forming a seat or recess for the spring 10 and associated with lugs 58 for retaining the spring and horizontal portions 59 extending outwardly from the morginal zones of the rounded portion 57. The outer free edges of the horizontal portions 59 come into contact along their radial extent with the cylinder walls and scrape the oil from said walls without any need for providing flat piston ring elements.

The bowed retaining lugs 58 which are formed by cutting out the strip 56 provide for the flow of the scraped oil passages 58a. Fulcrum lugs 60 are provided on the rounded portion 57 for cooperating with the horizontal portions 59 so as to urge them against the flanks of the piston groove due to the action of the component exerted by the spring 10.

Apertures 61 similar to the apertures 42 and 48 are staggered with respect to the retaining lugs 58.

WHAT I CLAIM IS :—

1. A device utilizable in a composite piston ring of the type comprising two annular oil-scraping elements having an inner edge and an outer peripheral edge, for operatively pressing said outer edge against the cylinder walls for scraping oil therefrom, characterized by the fact that it comprises an annular thrust strip or band providing on its inner surface a middle seat portion, and an annular spring compressively located within said thrust strip and seated on this strip seat portion, said strip having upper and lower edge bearing portions and being pressed through said edge bearing portions against the inner edge of said oil-scraping elements for operatively pressing the outer edge of said elements against said cylinder walls.

2. A device according to claim 1, wherein said strip is provided with retaining lugs or protrusions for retaining said annular spring on said middle seat portion.

3. A device according to claim 2, wherein said middle seat portion of the strip and said retaining lugs delineate a circular or non-circular locating space for said annular spring.

4. A device according to any preceding claim, wherein said strip has apertures for the flow of the oil scraped from the cylinder wall.

5. A device according to any preceding

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claim, wherein said strip is provided on its edge bearing portions with bent portions directed away from said oil-scraping elements for increasing the stiffness of said edge bearing portions.

6. A device according to any one of claims 1 to 4, wherein said strip is provided, between said middle seat portion and said edge bearing portions, with inwardly extending horizontal parts for supporting said oil-scraping elements.

7. A device according to claim 6, wherein said edge bearing portions are heel portions provided at the edge of said inwardly extending horizontal parts.

8. A device according to claim 6 or 7, wherein resilient supporting lugs or parts are provided between said middle seat portion of the strip and said inwardly extending horizontal parts for resiliently pressing said oil-scraping elements against the walls of the piston groove provided for the piston ring.

9. A modification of the device according to claim 1, wherein the edge bearing portions of the strips are replaced by outwardly directed horizontal parts resiliently pressed against the walls of the piston groove and having the outer free edge acting as an oil-scraping element of the piston ring.

10. A piston ring of the type comprising two annular flat oil-scraping elements and a device according to any one of claims 1 to 9.

11. A piston ring according to claim 10, wherein an axially-acting expanding element is located between said annular flat oil-scraping elements.

12. A device for exerting a radially directed thrust for piston rings, constructed and arranged substantially as described herein with reference to and as shown in Figures 1 to 4, or Figure 5, or Figures 6 and 7, or Figures 8 and 9, or any one of Figures 10 to 14 of the accompanying drawings.

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FIG. 1

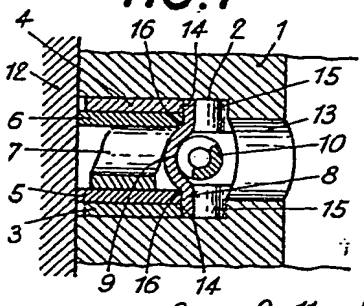


FIG. 2

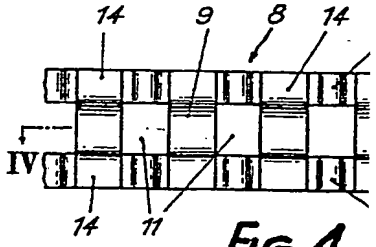
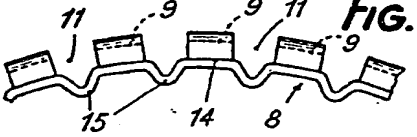


FIG. 3



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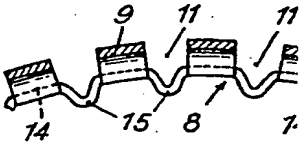


FIG. 5

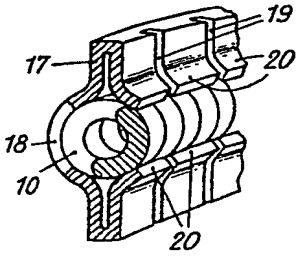
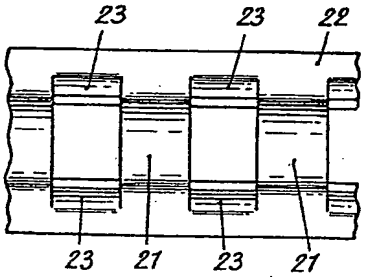


FIG. 7



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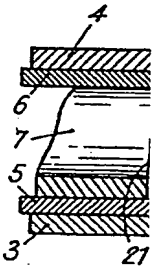
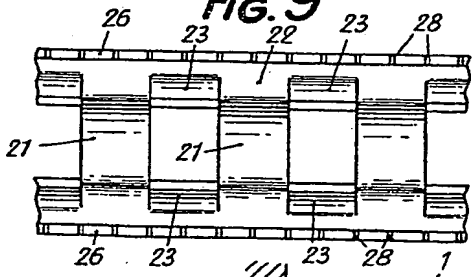


FIG. 9



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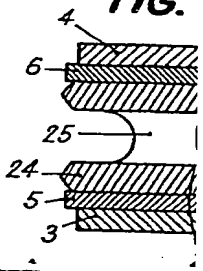
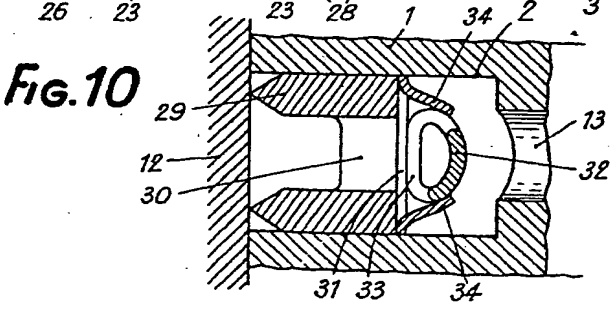


FIG. 10



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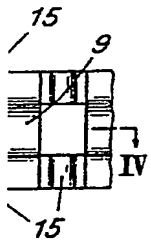
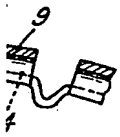
SHEETS 1 & 2





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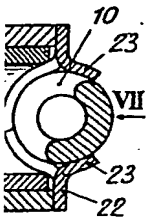

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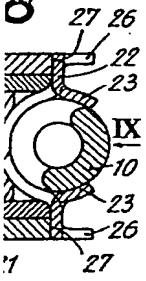

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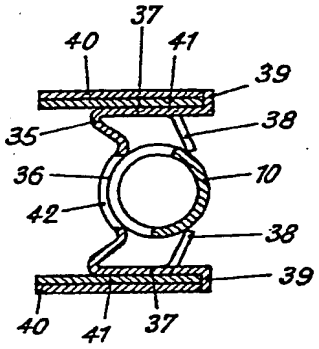


FIG. 12

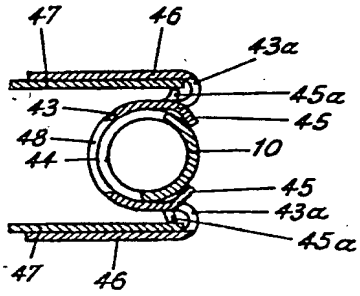


FIG. 13

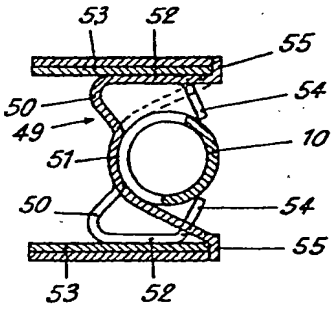
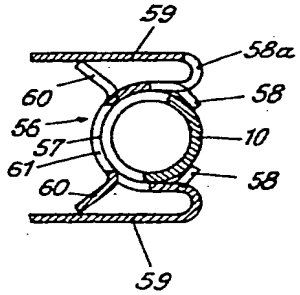


FIG. 14



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1,125,031 COMPLETE SPECIFICATION
2 SHEETS
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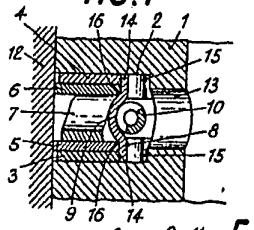
SHEETS 1 & 2

FIG. 1



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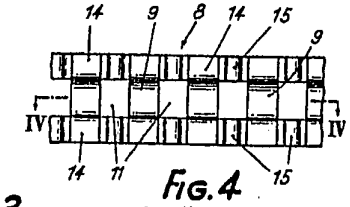

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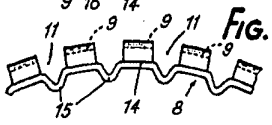

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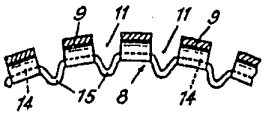

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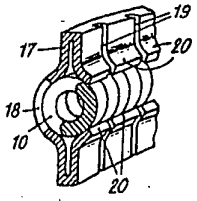

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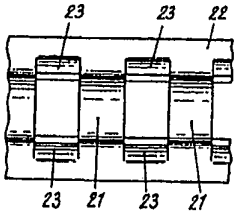

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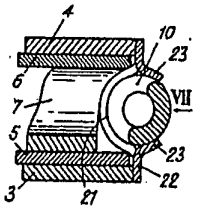

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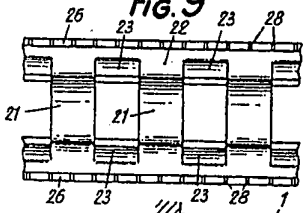

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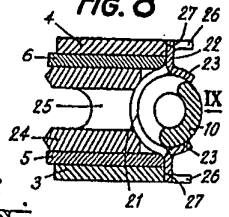
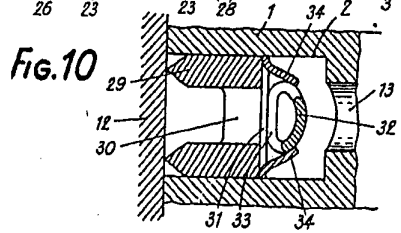


FIG. 10



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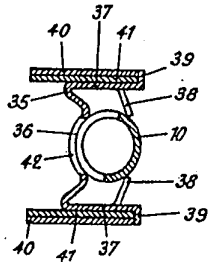

FIG. 12

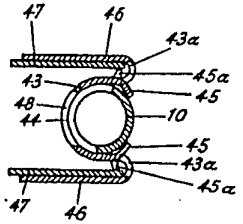

FIG. 13

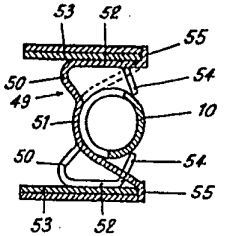

FIG. 14